Project Finance
Special Report

Bliss, Heartburn, and Toll Road Forecasts

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Summary

The U.S. capital markets have had a long history with start-up toll facilities, notwithstanding investors' disenchantment with the record of this class of assets over the last decade. The concept of repaying debt with toll revenues dates back many years. One can point to financings, such as those for the bridges across the Arthur Kill to Staten Island in the 1920s and the depression era financing of the Golden Gate Bridge in the early 1930s. In the 1940s, 1950s, and 1960s, the financings for the construction of sections of modern era turnpikes, such as the Pennsylvania Turnpike, Oklahoma Turnpike, New York State Thruway, and West Virginia Turnpike, and of bridge projects, such as the Chicago Skyway, Chesapeake Bay Bridge and Tunnel, and Sunshine Skyway, were accomplished with debt financings secured by toll revenues, some on a nonrecourse basis. These financings, some of which resulted in historic defaults, highlighted the difficulty with predicting traffic volumes and toll revenues for start-up projects. Fast forward to the 1990s, and nonrecourse, standalone, start-up projects like the San Joaquin Hills and E-470 toll roads that relied heavily on forecast traffic and revenue to support debt repayment and it is clear that the challenges remain.

This experience illustrates the incongruity between the strict full and timely payment discipline of the municipal market in the U.S. and the traffic ramp-up, market share, and growth risks of start-up toll roads. On the other hand, the benefits of tax-exempt debt have provided tremendous incentives to bring these two seemingly incompatible forces together. While tax exemption reduces financing costs, any added flexibility largely accrues to sponsors in reduced up-front public equity contributions, not in much needed additional flexibility to the financing structure of projects. In addition, today's high costs for project planning and development, right-of-way acquisition, and environmental mitigation in modern urban areas have resulted in maximum debt leveraging. The corollary is the need for revenue maximization through frequent, unapproved toll increases that are programmed at or near the top of the toll sensitivity curve, which then expose projects to political risk. Unfortunately, the wide range of uncertainty with toll road forecasts is inconsistent with tighter cash flows of highly leveraged projects and limited financial flexibility. In the current environment, Fitch Ratings considers greater public or private equity, lower debt gearing, higher coverage, and increased ratemaking flexibility to be essential for investment-grade ratings on the debt of start-up, standalone toll road projects.

Toll road forecasts remain critical inputs into the credit evaluation process. The fact that actual performance of the vast majority of start-up toll road forecasts has been heavily skewed on the downside, rather

than distributed around the most likely case, continues to raise the specter of positive bias and remains a matter of concern for the capital markets. When one looks back historically at projects, one sees that even if actual performance did not meet forecasts in the early years, it tended to gravitate back toward, and even exceed, the original forecast over time. That makes the argument for the base case to have been more representative of an upside case. Given that Fitch's ratings address the ability to pay each maturity on a full and timely basis, whether in the near, medium, or long term, it has called for some downward adjustment to reflect the uncertainties. Currently, sensitivities run by consultants and also by rating agencies provide the analytical tools to do so. However, the number of projects that have required expensive debt restructurings or have been downgraded illustrates the limitations of these tools and the need for enhancements to improve the quality of ratings. As stated in the "Redefining Toll Roads: An American Challenge" report published on March 4, 2003, "this experience is why Fitch raised the bar for an investment grade rating on the debt of these projects."

While actual traffic levels on the majority of recent standalone toll roads have been below forecast, projects like the President George Bush Turnpike around Dallas, TX and the Sam Houston Tollway around Houston, TX that are parts of an established toll system have exceeded forecast. Systems have actual data on existing segments to better calibrate models. Besides, they usually have less pressure to demonstrate self-sufficiency on any particular project as they have the ability to cross-collateralize, which is not the case with standalone projects. What is unclear, but is suggested by the recent track record, is if there is a pressure for forecasts to be more aggressive for standalone projects, which can ill afford that level of additional risk, than with system-related projects.

Fitch recognizes that there is analytical merit to the methodologies and techniques used by the major firms providing traffic and revenue forecasting services, and that there are limitations to their applicability in the debt markets. There is a need for constructive discussion and debate driven at improving the quality of information available to assess start-up toll roads, and this report intends to stimulate that process. For example, it is Fitch's opinion that an important step forward will include the construction of acceptable confidence bands of forecasted traffic and revenue. This would provide a meaningful enhancement and a more useful tool to employ in credit analysis. It would also represent an honest approach to highlighting the inherent uncertainties of toll road traffic and revenue forecasting. Given the dependence on demand forecasts in the broader project finance context, there may be applications of the thoughts expressed in this report that extend beyond the start-up, toll road sector.

Track Record on Standalone Projects

There are examples of standalone, start-up projects that have exceeded forecasts, such as Highway 407 (Toronto, Canada), Chesapeake Expressway (VA), and Mid-Bay Bridge (FL). Unfortunately, there are many more examples of such projects where actual traffic and revenue performance has significantly lagged the original forecast. Recent examples include Dulles Greenway (VA), E-470 (CO), Foothill Eastern (CA), Osceola Parkway (FL), Pocahontas Parkway (VA), San Joaquin Hills (CA), Garcon Point Bridge (FL), Sawgrass Expressway (FL), and Southern Connector (SC). The table on page 3 focuses on a few select, but representative, projects and demonstrates the key reasons identified for substandard performance. The patterns are readily discernible and provide a guide on how to approach analyzing these forecasts.

The key areas of vulnerability that have been identified in these forecasts are as follows:

Model Input Risk

- The use of regional travel demand models intended for other planning purposes and not necessarily appropriate for use to support the issuance of toll road debt. In the case of the original San Joaquin Hills toll road forecast, the local metropolitan planning organization's (MPO) travel demand model was used with its inherent land-use and socio-economic growth assumptions. Given that MPOs need to plan ahead for growth, this model made assumptions that were conducive for regional planning purposes but not sufficiently conservative to support future payments of the toll road's debt service on a full and a timely basis.
- The development of a steady-state forecast that does not incorporate the very real likelihood for traffic impacts during economic cycles. For example, the unanticipated impacts of the early

Select Forecasts

E-470 Public Highway Authority	Model Input Risk: • 1995 forecast assumed more aggressive development within the northeastern segments of the Denver beltway and greater traffic associated with Denver International Airport. • Higher than forecast concentration of traffic in southern portion of toll road, where toll rates are lower. • Recent economic downturn has slowed pace of development. Event/Political Risk: • Post Sept. 11, 2001 effects of reduced air travel at Denver International Airport. • High electronic toll violation rates due to inadequate software and hardware.
Foothill Eastern Transportation Corridor Agency	Model Input Risk: • Longer term effects of the deep recession of the early 1990s were not anticipated. • While employment growth was retarded to reflect the economic slowdown, baseline housing assumptions were not similarly adjusted, resulting in higher traffic projections. • Given the recessionary environment, inflation levels were lower than assumed, which lowered the value of time savings. • The relationship between weekend and weekday traffic was inaccurate, causing lower traffic on weekends. Event/Political Risk: • Also, a proposed extension of Alton Parkway to the corridor did not take place, and toll rates implemented at one plaza were 25% lower than assumed in the study.
Pocahontas Parkway Association	Construction Risk: • Completion delayed due to engineering issues; project opened in phases. Model Input Risk: • Lower inflation has lowered actual value of time, easily eating into the limited amount of time savings potential that the project currently offers. The justification for the project initially was primarily travel time and distance savings. • Original study done in 1996; 1998 update to study prior to the bond sale did not incorporate new trip tables, origin-destination and stated-preference surveys; 1996 information was factored up, instead. • The proportion of trucks was assumed to be about 9%, generating an average toll of $1.69; actual usage by trucks is significantly less, with trucks making up only a small fraction of total traffic, resulting in an average toll just barely above the $1.50 car toll. • Weekend traffic levels indicate a significantly lower share of traffic than was assumed in the study. • Seasonality was assumed to be small, suggesting a commuter-oriented facility; a 40% electronic toll share is the best indication of current commuter levels; limited experience over the past year indicates the potential for higher levels of seasonality, with peaks in the summer and troughs in the winter. Ramp-up Risk: • Initial market share was significantly lower and the period of ramp-up substantially longer than the high level of traffic and short ramp-up period assumed in the forecast.
San Joaquin Hills Transportation Corridor Agency	Model Input Risk: • The original 1993 forecast used a data set based on 1990 census results and did not anticipate the significant economic downturn and restructuring experienced in Southern California in the early 1990s. • It utilized an earlier version of the regional transportation model and a socio-economic forecast prepared for Orange County that was intended for planning purposes. As a result, there was an inherent level of positive bias that was not corrected to allow for alternative possibilities. • Lower weekend traffic than weekday traffic demonstrated inaccurate simplifying assumptions for that relationship. • Lower proportion of trucks than expected. Ramp-up Risk: • The concept of ramp-up was in its infancy, and a protracted ramp-up was not anticipated. Event/Political Risk: • A major widening project for competing I-5 and improvements to I-5 and I-405 corridor interconnections that occurred were not anticipated. • Initially, signing was poor.
Santa Rosa Bay Bridge Authority	Model Input Risk: • Narrower service area than anticipated with lower traffic potential within the service area than anticipated. • Unexpected closure of a large employer. • Drop in personnel at the local naval facilities that was not anticipated in the forecast. • Greater toll rate sensitivity – the absence of a regional travel demand model necessitated the use of the cost-ratio diversion curve from another bridge in another part of the state, which had different demographics and limited applicability to this project. Event/Political Risk: • An unexpected sewer moratorium restricted the pace of new development. • Signing was poor.

1990s recession in Orange County partially resulted in both the San Joaquin Hills and Foothill/Eastern toll roads not achieving their original forecasts.
- Weekend or truck traffic patterns can vary significantly from actual experience on comparable facilities that were used to develop an operating profile. This was evidenced with the Pocahontas Parkway and the San Joaquin Hills toll road.
- Value of time savings, a critical input into the model, the validity of which is very difficult to independently verify, can be different than assumed. This was the case with the Foothill/Eastern toll road and appears to be the case with the Pocahontas Parkway.

Ramp-up Risk

- The history until recently has been to largely ignore ramp-up. Efforts have been made over the last few years to capture the impact of ramp-up, but the methodology is largely based on using other operating facilities as a proxy. The results have been spotty. The limited ability to accurately predict ramp-up has been demonstrated with the San Joaquin Hills toll road and more recently with the Pocahontas Parkway.

Event/Political Risk

- A number of projects that have not met forecast can also point to the manifestation of event or political risk. Competing roads were improved ahead of time in the case of the San Joaquin Hills toll road, a proposed extension of a parkway to the Foothill/Eastern toll road did not take place, the widening of Route 7 severely impacted traffic on the Dulles Greenway, and a sewer moratorium slowed the pace of development in the vicinity of the Garcon Point Bridge.

Model error is the one vulnerability that has been given short shrift in traffic studies and has not been discussed in any postmortem analysis. The ability to model a real life situation is limited, let alone over a 30- or 40-year period. Each of the traffic forecasting models developed for these purposes inherently has some model error factor. Even if all the inputs and assumptions were, in fact, proved to be perfectly accurate, actual results would likely not match the forecast. This potential variability from the base case represents model error. Forecasters tend to point to model calibration and validation near 100% to actual traffic in a base year to make the case that model error is not a concern. Validation has been demonstrated to be more reliable when actual traffic counts on a toll road are available, but less so on greenfield projects. While the average error in a validation may be demonstrated to be small, the average may mask a problem, which when compounded within the model and over time, may severely skew results. This is an issue that is not discussed in an adequate level of detail in traffic and revenue reports.

Another broad observation is that in each of the toll road forecasts analyzed, the simultaneous manifestation of several vulnerabilities further contributed to these toll roads generating lower than expected traffic levels. This is extremely important because the simultaneous occurrence of these forecasting vulnerabilities can amplify the negative variance between projected and actual traffic levels. Any solution will need to accommodate the probability that multiple inputs could vary from the base case.

The Evolution

The traffic and revenue forecasting process has not been static. The leading consultants have incorporated lessons learned from prior experience into newer forecasts, although Fitch would argue that further improvements are necessary and achievable. Some of the steps taken by the leading traffic and revenue consultants to improve the integrity of forecasts include:

Model Input

- Travel demand models that reflect metropolitan planning organization perspectives are now being modified to better reflect the characteristics of toll road projects. Land-use and socio-economic assumptions are modified to reflect more conservative scenarios based on historical data and future expectations, as in the case of the Central Texas Turnpike project, where population and employment projections were markedly lower than both historical experience and near to medium term expectations for the future, even after considering the region's recent economic slowdown.
- There is more in-depth analysis of potential land-use patterns following discussion with regional planners, state and local officials, and private land developers that incorporate some conservatism into the pace and nature of

development. This allows for a better understanding of vulnerabilities in the forecast to land development assumptions, which tend to be a key risk for many start-up projects. In Fitch's view, the use of independent land-use consultants has been an important step in furthering that effort.

- In the case of Northwest Parkway, development was retarded by five years as a base case assumption to reflect the uncertainty associated with the nature and pace of development. The State Route 125 project near San Diego also incorporated some conservatism by reducing nonresidential growth forecasts below levels projected by the independent consultant within the primary service area. These are good examples of positive steps taken by traffic and revenue consultants to recognize the limitations in their ability to predict economic performance and compensating by incorporating a level of conservatism.
- Development of models to more accurately reflect traffic patterns and demand — peak, off-peak, midday, night, and weekend, among others. The commuter driven demand associated with projects like the San Joaquin Hills and Foothill/Eastern toll roads required peak and off-peak models. The Chesapeake Expressway addressed significant weekend congestion in the summer and used a weekend model to predict traffic levels in that critical period. The significant hourly variability of traffic on the State Route 91 Express Lanes required Friday and weekend modeling in addition to weekday AM and PM peak and off-peak modeling. This additional diligence in the modeling exercise reduces risk from simplifying assumptions. In addition, the growing complexity of projects demands greater precision.
- Additional attention and consideration is being given to potential changes in the network and for potential modal shifts with the planned implementation of commuter rail and enhanced bus services in many areas. This has been a standard practice for some time now but has received increased focus due to multimodal corridor planning and development. Past experience with the introduction of unplanned improvements (i.e. event/political risk) has resulted in the evaluation of traffic impacts under alternative implementation schedules.

Ramp-up

- Ramp-up continues to retain an element of mystery. However, with experience there is a growing ability to identify the broad characteristics of ramp-up based on the type of facility. Fitch has observed an inverse relationship between time savings and ramp-up, so that greater time savings seem to correlate with a shorter traffic ramp-up. Similarly, it seems that ramp-up experience is shorter for projects that address existing urban congestion but longer for projects whose economic value is more dependent on future development. Nevertheless, Fitch is unaware of any formal study of these relationships.
- In an attempt to recognize the potential for extended ramp-up and to lend a level of conservatism to the forecast, the Central Texas Turnpike project's State Highway 130 (SH130) component, which is development dependent, was assumed to have a long, six-year ramp-up. At the same time, the more urban State Highway 45/Loop I components were also assumed to have relatively protracted, four-year ramp-ups. In the case of SH130, the consultant used the ramp-up experience from the Seminole and Veterans expressways in Florida, which started off at a lower base of about 50% and had longer ramp-ups. Northwest Parkway also used a five-year ramp-up to partially compensate for the dependence on development on either end of the road. These are also good examples where the inability to accurately predict a key factor was balanced by very conservative assumptions.

Sensitivities

- Attempts have been made through sensitivity analysis to quantify the degree to which actual experience could differ from that assumed in the base case traffic and revenue forecast. However, these attempts have only begun to scratch the surface in testing the complexities associated with changing conditions. The sensitivities are uni-dimensional in most cases and study the potential for slower economic growth, delayed development, lower value of time, accelerated competing improvements and delayed complimentary improvements. They do not recognize the wide range of potential outcomes, which include the possibility for these scenarios to be manifested both independently and in conjunction with each other. They also do not demonstrate tolerance for delayed or lower toll

Key Considerations in Fitch Ratings' Analysis of a Recent Project

Central Texas Turnpike

- Lower rates of population and employment growth than can be reasonably expected in the region.
- Number of competitive regional highway network improvements assumed are unlikely to occur within the timeframes assumed because of budgetary and other constraints.
- Growing congestion on Interstate 35 with significant delays at most times of the day.
- Travel time savings in the various corridors served by the project expected to be significant due to the level of congestion.
- Potential for significant time savings partially mitigates risk in early years of operation with the level of acceptance of tolls in an area where drivers are not accustomed to paying tolls.
- Projected toll rates well below the maximum revenue points on the toll sensitivity curves generated by the forecaster's models and infrequent increases provide rate-making flexibility.
- Quicker ramp-up on SH45 and Loop 1 likely than the four years assumed (as they are commuter facilities and congestion relievers), and appropriately conservative six-year ramp-up on development dependent SH130.
- Fitch's stress scenario assumed reduced auto and truck traffic on the project based on five-year delayed land-use and reductions in the value of time to reflect these concerns with the steady-state forecast. The scenario incorporated greater reductions in the development dependent SH130 than on Loop 1 and SH45, including a 50% reduction on trucks on SH130 given the reliance on this source of high margin revenue.

Note: Despite the many positive and conservative aspects of the traffic and revenue forecasts of the Central Texas Turnpike project, the uncertainties with steady state forecasts and the project's high development cost would not have supported a debt heavy financing structure. Sizable public equity and subordinated debt that allowed for lower senior debt gearing and few assumed toll increases provided the financial flexibility essential for a robust structure that strongly justified an investment-grade rating on the long-term senior debt. SH – State highway.

increases. As stated earlier, in each of the forecasts identified on the table on page 3, more than one event occurred at the same time: construction risk; model input risk; ramp-up risk; and event/political risk.

Varied Approaches to Credit Analysis

To compensate for the reliability of start-up toll road traffic and revenue forecasts and the long lead time that it takes for these projects to develop a significant revenue base, back-loaded debt structures with frequent assumed rate increases have become a staple. However, these structures put onerous financial demands on projects, increase the debt burden considerably, and limit financial flexibility, since incremental growth in revenues are continuously absorbed by escalating debt service requirements. The limitations of these financing structures and of their respective traffic and revenue forecasts are sometimes viewed as constraints to the ability to bringing new projects to market. They also lead to varied approaches to credit analysis.

Some market participants have made assertions that the premise for stress testing traffic and revenue forecasts should be statistical adjustments according to their historical track record for accuracy or inaccuracy. It has even been suggested that stress testing in a certain country be tied to who the sponsor of the project is and the track record of forecasts in that country. With such a limited population of projects in each country — less than a handful in many and barely a few more in others — there are not enough data points to make statistically meaningful arguments for such approaches. The world is much more complex than that, the dynamics of each project are different, and so are the pressures. Underlying assumptions for socio-economic factors, transportation network and modal alternatives, and the quality and usefulness of preference surveys are unique to each project. Making the simplifying assumption that a small set of data points is adequate to be the guide for a stress test does not do justice to the complexities of toll road projects and their underlying economics.

Fitch takes a more in-depth approach to rating toll road projects. Fitch studies the major inputs and assumptions in the travel demand model (socio-economic factors, the transportation network, modal alternatives, the value of time hypothesis, and competition, among others) and makes determinations as to the range of possibilities associated with each of these key factors, given the exposure to business cycles, structural economic shifts, and event and political risks. It allows Fitch to develop an investment-grade stress scenario based on the characteristics of the toll road and the local demand profile. This approach has evolved over time, as Fitch has had to take negative rating action on the debt of a number of projects over the last few years.

The one element that Fitch has limited ability to incorporate using pure analytics is model error.

While using more draconian assumptions than experience might indicate, such as prolonged recessions and acceleration of competing improvements despite the lack of funding, has provided a means for Fitch to accommodate model error into its ratings analysis, this is clearly a less than ideal approach. It is at times punitive to projects but is currently necessary.

What Next?

To the extent that traffic and revenue forecasts can be tailored to meet the needs of the capital markets and bondholders, credit risk could be moderated and financial structures could be more tightly designed to meet the needs of the project, the sponsor, and investors. The more stability in financial performance and credit quality that can be brought to the market place, the greater the potential for mitigation of underperformance risks, which would accrue in the form of savings to both investors and sponsors.

Having studied a number of start-up toll road projects over the years and evaluated the successes and failures of their traffic forecasts, Fitch has identified certain steps that could add value. It is Fitch's hope that new and alternative solutions will also come to the fore and engender improved forecasts.

Enhanced Forecasting

- There is a need for forecasts to incorporate the likelihood for multiple possibilities given the low probability that the base case forecast will actually be the likely outcome. There clearly is value in a base case or most likely forecast, but for the rating of debt, that alone is too simplistic an approach. To appropriately analyze credit quality and rate debt, one needs to develop an acceptable confidence band surrounding the range of possible outcomes. The lower end of the band would provide the basis for developing a financial structure intended for the debt markets, and the upper end of the band would provide the argument for private equity participation, early debt retirement, or future financial capacity to expand the project. This information could also identify the need for government subsidy. In other parts of the world, efforts have been made in this regard through the creation of upside and downside cases. Further work is necessary to correlate these cases to rating levels.
- Current forecasting methods aim to pick a set of reasonable assumptions. While possibly reasonable, they represent only one of many possible set of outcomes and are almost guaranteed to be off-target given the complexities of the world around us. To develop a confidence band, one needs to begin with building ranges of possibilities around each input variable with acceptable confidence limits on the upside and downside. Careful selection of the appropriate tool to be used is important. In theory, the use of Monte-Carlo simulations has appeal, but it will only be as good as the assumptions. The practicality of a Monte Carlo simulation versus discrete scenarios will need to be evaluated as both could theoretically achieve the desired results.
- This thought process could lead to analyses that incorporate the compounded effects of different assumptions and changed conditions. One needs to consider, for example, the potential that a changing economic environment can result in different values of time, that an economic downturn may not result in a strong recovery, and that over the tenor of long-term debt there is a high likelihood for multiple economic cycles. Event and political risk also need to be incorporated, such as the potential for acceleration of competing improvements, the delay in construction of a complimentary artery, or the delay in implementation of a toll increase. This information will advance the understanding of the project's risk profile. It is then up to the reader of the study to make the subjective judgments as to the likelihood of occurrence.

Value of Time and Ramp-up

- Value of time is in some ways the X-factor of toll road forecasting. It is a critical input into the model and the most difficult to independently validate. It essentially involves attempting to understand and quantify human behavior — no easy task. Unlike differing economic conditions, which can be independently verified, one can only indirectly approximate the potential value of this important input. In some ways, the concept of ramp-up is inherently tied to human behavior and the human response to a new transportation choice.
- Travel demand models assume the fastest route as the basis for the model. Human beings do not figure the benefits as quickly or efficiently as computers. Methods need to be improved to better reflect the learning curve. We all know there usually is a slower rate of acceptance in the early months and years after a toll road opens

and an acceleration of acceptance in later periods as options are clearer and congestion levels grow. Therefore, would the incorporation of a evolving perception of value of time better reflect the human response and result in a better forecast than the current method? Rather than apply overall adjustment factors to traffic and revenue as a proxy, is there value in marrying the concept of ramp-up and the evolutionary nature of one's willingness to pay and one's perception of value of time savings relative to any new choice?

- Ramp-up is also affected by decisions made by project sponsors as they relate to the implementation of the project, such as phased openings, incentive programs to use the facility, and the quality and adequacy of marketing and signing, among others. There needs to be a linkage between the assumptions made by the traffic and revenue consultant and the commitments and plans of the project sponsor.

Detailed Truck Traffic Analysis

- The high revenue margin brought in by trucks is an issue when trucks are projected to be more than an insignificant fraction of traffic. It is not adequate to point to the growing need for just-in-time deliveries or the higher willingness to pay for business travel because the value of time savings argument has in many cases not held up. Truckers at times make irrational decisions. An owner/operator may perceive their value of time savings much lower than a fleet manager whose decisions are likely based on more careful analysis and who dictates the route drivers should be taking. More in-depth study of trucking patterns and preferences needs to be done to better understand truckers' proclivity to use or not use a toll road given the high tolls they pay.

Electronic Toll Collection

- With electronic toll collection, the prospect of lost revenue from toll violations and toll evasion is greater. Studies tend to ignore this issue. Violations are a meaningful risk to achieving forecast revenues and need to be incorporated into the analysis. With a number of years of experience across the country and abroad under varying conditions, there are data that should be able to facilitate an assessment of probable rates of violations, the accuracy of equipment and software systems used to track it, and the potential for revenue recovery through penalties, among others. Nevertheless, this experience does not seem to be well publicized.
- The potential for more high occupancy toll lanes in the median of existing highways that incorporate open road tolling technology is going to put this issue front and center. There is greater potential for negative revenue impact from violations due to current limitations in imaging and license plate tracking processes. Also, high occupancy vehicle and bus usage and growth patterns will be important to study given their impact on revenue potential.
- On the other hand, the ability to more aggressively implement variable pricing schemes to impact demand and maximize revenue using the flexibility provided by electronic toll collection technology also needs some focus.

Enhanced Model Validation

- The validation process has been used in the past to justify the accuracy of the model and make the argument that there is no inherent bias in the model. Manual adjustments are often made to refine the distribution of traffic to validate the model. By definition then, the model is subject to model error.
- Putting one's finger on model error will not be easy. There may be statistical methods that provide a range of possible error factors. In addition, the forecaster's assessment of the robustness of the model being used should provide a sense of the level of comfort with the model. Quantifying that assessment will be useful.
- There may be ways to increase one's confidence in the veracity of the model by enhancing the validation process. One option is to validate more than one year in addition to the base year and the origin. Other methods may also exist and need to be pursued.
- While practical considerations, including cost, will limit the ability to make enhancements, the ultimate focus should remain on enhancing investor understanding of the exposures to modeling and incorporating that risk into the final product. This should include full disclosure of the limitations of the model to the characteristics of the toll road and the manual adjustments made to calibrate the model to achieve validation. The inadequacies of the model should also be a basis for sensitivity analysis.

Establishment of Basic Forecasting Criteria

- Besides the discussion in reports as to what approaches or modeling techniques have been used and the occasional presentation at conferences, there has been no in-depth criteria piece that has been published by any of the leading traffic and revenue consultants. Without an adequate level of publicly available research on the subject, standards are unclear and the quality of the product differs depending on the consultant, the views of the client and its agents, and the budget. To improve access for more toll road projects to the capital markets, more transparency needs to be created to erase the perception of the proverbial "black box."
- To ensure that the product is satisfactory, adequate resources (time and money) also need to be allocated to its development. This should not be construed as calling for a blank check for these studies, but instead as a requirement that minimum standards need to be met if a toll road project that is solely dependent on projected revenues is to achieve investment-grade ratings. Additional up-front costs will pale in comparison to the millions and millions of dollars in lost value that investors have absorbed for less than adequate studies. There are also meaningful consequences to project sponsors from the current state of affairs. Investors are looking for interest premiums to be compensated for the perceived uncertainties surrounding toll road forecasts. The brunt of the impact is ultimately felt on the feasibility of projects — higher costs will lower the number of projects that can be brought to market.

Improved Review and Increased Competition

- Peer reviews have been done in the past, but the value has been somewhat limited. To benefit from this process, detailed reports need to be prepared that discuss the extent of the review and the results. Independent meetings and discussions with rating agencies would further the credibility of the peer review process.
- Currently, there is the perception that only forecasts from a very small group of firms that provide these services will be acceptable to achieve investment-grade ratings. Fitch does not have any such requirement. A broader universe of firms will provide much-needed competition and the necessary incentives to sharply improve the quality of forecasts.

■ Conclusion

An example from the merchant power sector helps one put the risks of the start-up toll road sector in perspective. In England and Wales, producers have had to adapt to profound changes in the market. The fundamental market theory that, as gas prices rise and power prices fall, the least cost-efficient plants will be retired allowing the more cost-efficient plants to operate, has broken down in the short term. Factors that partially insulated generation capacity from market movement played a role. In the long term, one would expect those barriers to erode and more cost-efficient plants to regain a stronger position. If established theories can break down in the power market, which is generally more efficient, one should not be surprised that established hypotheses, such as value of time, can also break down for a period of time in the road sector, which is not as efficient. Therefore, for a period, the fastest route may not attract its natural share of traffic and, despite quantifiable travel time savings, drivers may choose an alternative route. On the other hand, although the relative inefficiency of the road sector can hurt a project in its early years of operation, it can also help in later years as subsequent changes in the network will take longer to be incorporated into travel patterns. Forecasts need to reflect these characteristics of the sector.

Even prior to the constrained budgets of today, highway infrastructure investment was lagging behind the demands of the day. The backlog is guaranteed to get bigger under the current environment. The concept of tolling highways, including the interstates, is receiving greater acceptance from policy makers as a means to enhance the movement of people and the delivery of goods and services. States are looking more closely at the tolling option to fund capacity expansion and new projects. In order to facilitate this process, reliable traffic and revenue forecasting is an essential ingredient. Since that will not happen overnight, greater public or private equity to reduce a project's debt load and more flexible financial structures will be essential in the interim. To the extent that does not happen, investment-grade ratings will be difficult to achieve and risk premiums will remain high, potentially limiting the number of projects that can be financed with nonrecourse debt.

Enhanced modeling and analytic techniques are important next steps that could provide the market the opportunity to develop more workable and more

enduring financing structures. It may also allow the market to better incorporate the credit fundamentals of toll roads through alternative structures that take advantage of the ultimate recovery potential of toll roads.